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ILLINOIS STATE GEOLOGICAL SURVEY

NATURAL RESOURCES BUILDING
URBANA, ILLINOIS 61801

JOHN C. FRYE, CHIEF

115 South Washington Street
Naperville, Illinois 60540
October 11, 1968

RECEIVED

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DIVISION OF SANITARY ENGINEERING
ILLINOIS DEPT. OF PUBLIC HEALTH

Mr. Clarence W. Klassen
Chief Sanitary Engineer
Department of Public Health
Springfield, Illinois

Dear Mr. Klassen:

This is in response to a request by Mr. Verdun Randolph regarding the installation of a clay liner at a proposed disposal site in the SW $\frac{1}{4}$ of Section 15 T37N, R12E, Cook County, Illinois. This liner will be used to reduce the outward migration of dissolved solids from the fill materials.

We have found in our studies of landfills in northeastern Illinois that there is an appreciable reduction in the chloride ion content of refuse leachate as it moves through undisturbed silty clay tills. The enclosed table shows some of our results to date.

With regard to this table the following points should be considered:

- 1) Chloride values vary from week to week; however, based on all of our data it appears that values of 50 ppm or less can be considered as normal ground water. Samples with chloride values between 50 and 150 ppm may represent the influence of leachate and values greater than 150 ppm probably show the influence of leachate from the landfill.
- 2) Chloride values within the fill and in permeable materials immediately beneath the fill show wide variation. At or near each location, however, we would expect that values exceeding 1000 ppm could be obtained in these materials.

Chloride Migration

Sampling Point	Age of Fill	Distance Moved through Till (ft)	Chlorides (ppm) (Hach Kit)	Comments
LW 10 DuPage LW 12A " LW 11A " LW 11B "	3-6 years	11.5 7.5 1.5 0	137 13 13 1450	Possibly leakin
LW 14 DuPage LW 15 " LW 16 " LW 6B "	approx. 14 yrs.	14 5 1 0	38 150 500 300	Not typical
LW 14 Winnetka LW 15 " LW 16 "	1 year	16 8 2	50 38 38	
LW 10A Winnetka LW 12 " LW 11 " LW 10B "	approx. 15 yrs.	21 6 0.5 0	100 113 1200 150	Variable (37.5-1325 ppm Variable (50-600 ppm cl) Leaking Not typical

- 3) Analyses of leachate components other than chlorides have not been run; however, water bailed from points within the till (except LW 11 Winnetka) is clear and odorless.

The foregoing table indicates that the chloride concentration in refuse leachate is substantially reduced by passage through undisturbed silty clay till and as chloride ions are among the most easily transported, we conclude that the concentration of other dissolved solids will be reduced even more.

The permeability of the silty clay tills studied were on the order of 10^{-6} cm/sec. Permeabilities of this magnitude, and lower, depending on the materials, are possible with treated and untreated compacted earth liners. Thus it seems likely that a properly constructed clay blanket could be used to substantially reduce the movement of dissolved solids from this waste disposal site.

The following additional points should also be mentioned:

- 1) The quantity of fluid moving through the clay blanket is not a function of the thickness of the blanket. The thickness of the blanket is directly related to the time involved in moving water through it, and probably to the attenuation of dissolved solids in this water.
- 2) The liner should be continuous, not only over the base of the site, but on the sides. It is, therefore, suggested that the compacted liner be a minimum of one foot thick, and be covered with a layer of sand or gravel to prevent its rupture by machinery, or by overlying refuse. A small break in this liner would allow rapid draining of the leachate out of the site, in much the same manner as removal of the plug in a bathtub, so proper installation is very important. ✓
- 3) If this site is properly lined it will retain most of the rain and surface water entering through the top. It should, therefore, eventually fill with water and overflow. The amount of water flowing out of the pit after it fills will depend in large part on the measures taken to seal the top and to reduce surface drainage into the fill. According to the literature, treatment for the reduction of the organic content of refuse leachate can be accomplished relatively inexpensively using gravel filters. ?

4. Unless local groundwater movement is modified by substantial increases in groundwater pumpage, it is expected that any dissolved solids leaving the site should remain near the top of the zone of saturation and move to the Calumet Sag Channel. Therefore, if the clay liner is less efficient than expected in retarding dissolved solids only a limited amount of pollution will result. The quantity of water moving through this liner is estimated to be between 10^{-3} and 10^{-4} gallons per day per square foot of submerged liner.

The foregoing is based on our studies of landfills in northeastern Illinois and a survey of the literature. As this study has not yet been completed there is a possibility that some of our conclusions will be modified by later data, although it is not anticipated that these modifications will be extensive. Comments regarding clay liners and leachate treatment are based on literature available on this subject and not on our own work and we would be pleased to have your office look at this literature before final conclusions are drawn.

We will be glad to discuss this further with you and you may look over the latest results of our investigation and our collection of references at your convenience.

Yours very truly,

George M. Hughes

George M. Hughes
Associate Geologist
Northeastern Illinois Office
Section of Groundwater Geology
and Geophysical Exploration